

Nemko Test Report: 116423-1TRFWL

Applicant: Energate Inc.
2415 Holly Lane, Suite 210
Ottawa, ON
K1V 7P1

Apparatus: ZRM10

FCC ID: WUR-ZRM10

In Accordance With: FCC Part 15 Subpart C, 15.247
FHSS System and Digitally Modulated Radiators
902-928MHz, 2400 - 2483.5 MHz, 5725-5850MHz

Authorized By:



Andrey Adelberg, EMC/Wireless Specialist

Date: December 9, 2008

Total Number of Pages: 28

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Section 1 : Report Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003.

The assessment summary is as follows:

Apparatus Assessed:	ZRM10
Specification:	FCC Part 15 Subpart C, 15.247
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None
Report Release History:	Original Release
Test Location:	Nemko Canada Inc. 303 River Road Ottawa, Ontario K1V 1H2
Registration Number:	176392 (3m Semi-Anechoic Chamber)
Tests Performed By:	Jason Nixon, Wireless/Telecom Specialist
Test Dates:	December 1 to 3, 2008

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Section 2 : Equipment Under Test

2.1 Identification of Equipment Under Test (EUT)

The following information identifies the EUT under test:

Type of Equipment:	Zigbee Module
Brand Name:	Energate
Model Name or Number:	ZRM10
Serial Number:	603290030 (radiated), 603290014 (conducted)
Nemko Sample Number:	1, 2
FCC ID:	WUR-ZRM10
Date of Receipt:	December 1, 2008

2.2 Accessories

The following information identifies accessories used to exercise the EUT during testing:

Description:	Evaluation board
Brand Name:	Ember
Model Name or Number:	EM250 breakout board
Serial Number:	04550724040603A4
Nemko Sample Number:	3
Connection Port:	extender cable
Cable Length and Type:	10cm

Description:	DC Power supply
Brand Name:	Potrains Electrical Corporation
Model Name or Number:	WD411200500
Serial Number:	None
Nemko Sample Number:	4

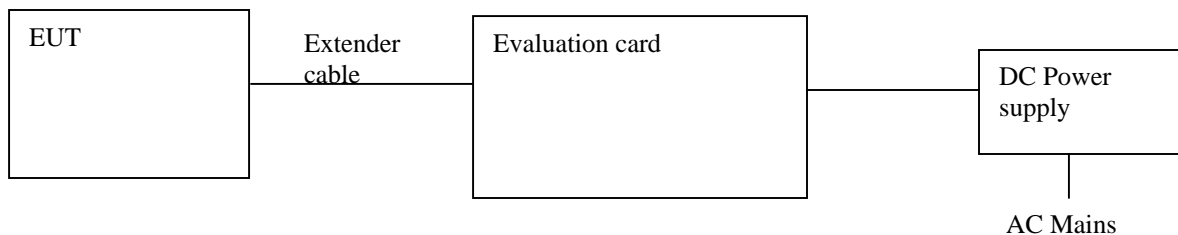
2.3 EUT Description

The EUT is a Zigbee module operating in the 2.4GHz ISM band.

2.4 Technical Specifications of the EUT

Operating Band:	2400-2483.5MHz
Operating Frequency:	2405-2480MHz
Modulation:	OQPSK
Channel Bandwidth:	5MHz
Emission Designator:	G1D
Antenna Data:	Integral 1.5dBi chip antenna
Power Supply Requirements:	3.3VDC

2.5 EUT Setup diagram



2.6 Operation of the EUT during testing

Commands were sent to the module over a serial port on the evaluation board to set the EUT into a continuous transmit mode.

2.7 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

Section 3 : Test Conditions

3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.247

FHSS System and Digitally Modulated Radiators
902-928MHz, 2400 - 2483.5 MHz, 5725-5850MHz

3.2 Deviations From Laboratory Test Procedures

No deviations were made from laboratory test procedures.

3.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	15 – 30 °C
Humidity range	:	20 - 75 %
Pressure range	:	86 - 106 kPa
Power supply range	:	+/- 5% of rated voltages

3.4 Measurement Uncertainty

Nemko Canada measurement uncertainty has been calculated using guidance of UKAS LAB 34:2003 and TIA-603-B Nov 7, 2002. All calculations have been performed to provide a confidence level of 95% and can be found in Nemko Canada document MU-003.

3.5 Test Equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Cal. Date	Next Cal.
Spectrum Analyzer	Rohde & Schwarz	FSU46	FA001877	Aug 28/08	Aug 28/09
3m EMI Test Chamber	TDK	SAC-3	FA002047	May 06/08	May 06/09
Bilog	Sunol	JB3	FA002108	Jan. 21/08	Jan. 21/09
Flush Mount Turntable	Sunol	FM2022	FA002082	NCR	NCR
Controller	Sunol	SC104V	FA002060	NCR	NCR
Mast	Sunol	TLT2	FA002061	NCR	NCR
LISN	Rohde & Schwarz	ENV216	FA002023	Sept. 02/08	Sept. 02/09
Receiver/Spectrum Analyzer	Rohde & Schwarz	ESU 26	FA002043	Dec. 07/07	Dec. 07/08
50 Coax cable	HUBER + SUHNER	None	FA002015	Aug. 05/08	Aug. 05/09
50 Coax cable	HUBER + SUHNER	None	FA002022	July 07/08	July 07/09
50 Coax cable	HUBER + SUHNER	None	FA002074	July 07/08	July 07/09
International Power Supply	California Inst.	3001i	FA001021	Jan. 16/08	Jan. 16/09
Horn Antenna #2	EMCO	3115	FA000825	Jan. 15/08	Jan. 15/09
18.0 – 40.0GHz Horn Antenna	EMCO	3116	FA001847	May 12/08	May 12/09
1 – 18 GHz Amplifier	JCA	JCA118-503	FA002091	Oct 2/08	Oct 2/09

COU – Calibrate on Use

NCR – No Calibration Required

Section 4 : Results Summary

This section contains the following:

FCC Part 15 Subpart C : Test Results

The column headed 'Required' indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N No : not applicable / not relevant.

Y Yes : Mandatory i.e. the apparatus shall conform to these tests.

N/T Not Tested, mandatory but not assessed. (See Report Summary)

4.1 FCC Part 15 Subpart C : Test Results

Part 15	Test Description	Required	Result
15.31(e)	Variation of power supply	Y	PASS
15.207(a)	Powerline Conducted Emissions	Y	PASS
15.209(a)	Radiated Emissions within Restricted Bands	Y	PASS
15.247(a)(1)	Frequency hopping systems	N	
15.247(a)(2)	Systems using digital modulation techniques	Y	PASS
15.247(b)(1)	Maximum peak output power of Frequency hopping systems operating in the 2400-2483.5 MHz band and 5725-5850 MHz band	N	
15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902-928 MHz band	N	
15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands	Y	PASS
15.247(b)(4)	Maximum peak output power	Y	PASS
15.247(c)(1)	Fixed point-to-point Operation with directional antenna gains greater than 6 dBi	N	
15.247(c)(2)	Transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams	N	
15.247(d)	Radiated Emissions Not in Restricted Bands	Y	PASS
15.247(e)	Power Spectral Density for Digitally Modulated Devices	Y	PASS
15.247(f)	Time of Occupancy for Hybrid Systems	N	

Notes:



Appendix A : Test Results

Clause 15.207(a) Powerline Conducted Emissions

Frequency of Conducted limit (dB μ V)		
Emission (MHz)	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

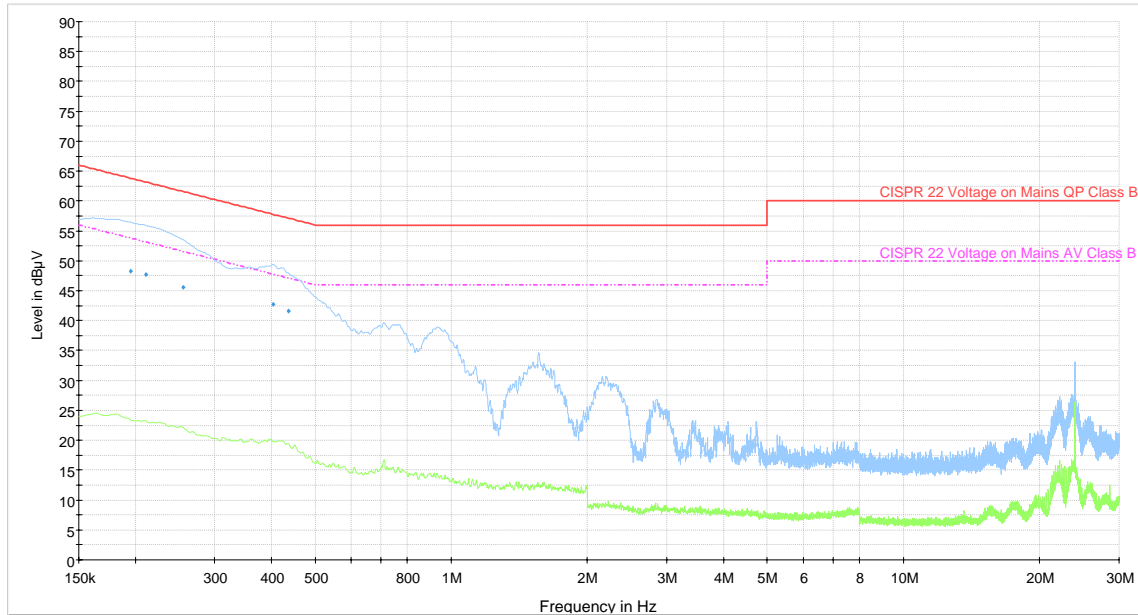
* Decreases with the logarithm of the frequency.

Test Results: Pass

Additional Observations:

All plots were obtained using a sweeping receiver with an IF of 9kHz using a Peak and Average detector. The plots have been corrected with the cable loss and LISN loss to show compliance.

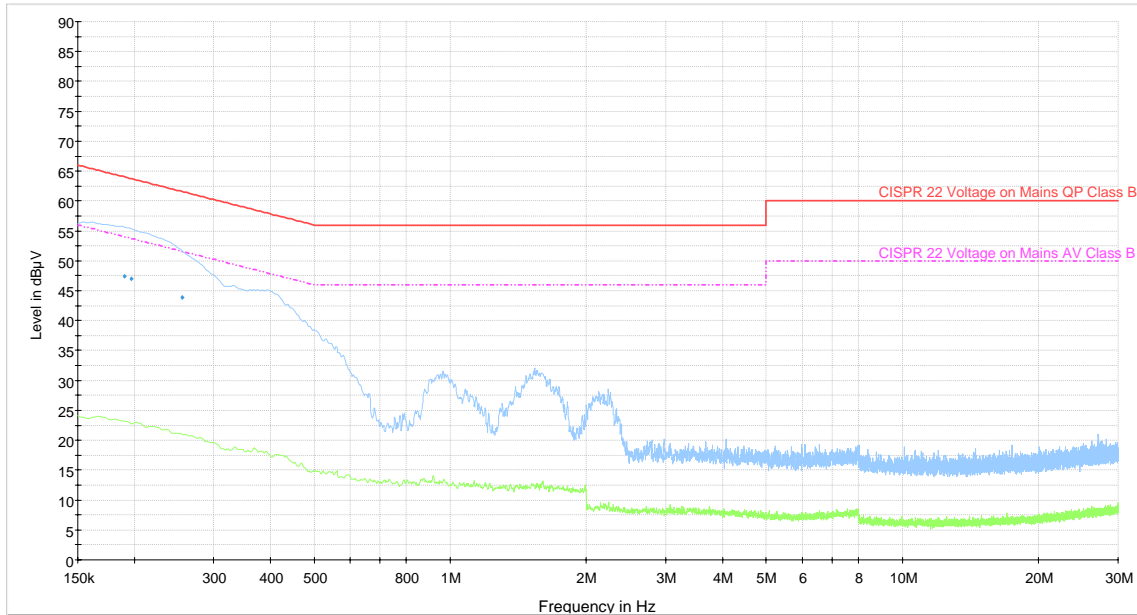
Phase



— CISPR 22 Voltage on Mains QP Class B — AC Power line conducted - Phase — Pre-Scan Peak Detector
 — CISPR 22 Voltage on Mains AV Class B • Final Measurement Quasi-Peak Detector — Pre-Scan Average Detector

Frequency	QuasiPeak	Meas. Time	Bandwidth Filter	Line	Corr.	Margin	Limit
MHz	dBµV	ms	kHz		dB	dB	dBµV
0.1950	48.28	100.00	9.00	On	L1	10.13	63.82
0.2108	47.73	100.00	9.00	On	L1	10.03	63.18
0.2558	45.61	100.00	9.00	On	L1	10.02	61.57
0.4043	42.72	100.00	9.00	On	L1	10.02	57.77
0.4358	41.56	100.00	9.00	On	L1	10.04	57.14

Neutral



— CISPR 22 Voltage on Mains QP Class B - - - CISPR 22 Voltage on Mains AV Class B — AC Power line conducted - Neutral
 — Pre-Scan Average Detector • Final Measurement Quasi-Peak Detector — Pre-Scan Peak Detector

Frequency	QuasiPeak	Meas. Time	Bandwidth Filter	Line	Corr.	Margin	Limit
MHz	dBµV	ms	kHz		dB	dB	dBµV
0.1905	47.42	100.00	9.00	On	N	10.20	64.01
0.1973	47.04	100.00	9.00	On	N	10.07	63.73
0.2558	43.87	100.00	9.00	On	N	10.00	61.57



Clause 15.209(a) Radiated Emissions within Restricted Bands

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvoltsmeter)	Measurement Distance (meters)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Results: Pass

Additional Observations:

The Spectrum was searched from 30MHz to the 10th Harmonic.

These results apply to emissions found in the Restricted bands defined in FCC Part 15 Subpart C, 15.205.

The EUT was measured on three orthogonal axis.

All measurements below 10GHz were performed at 3m and measurements above 10GHz were performed at 1m.



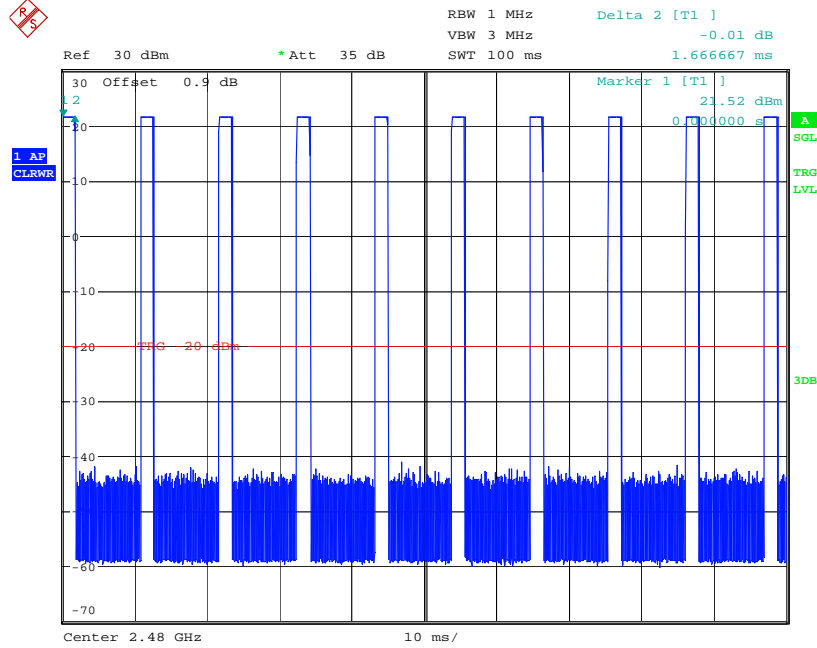
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Frequency (MHz)	Polarity	RCVD Signal (dBuV)	Ant. Factor (dB)	Cable Loss (dB)	Amp. Gain (dB)	Duty Cycle Corr.	Distance Correction	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	
1	7215	V	62.47	36.5	8.3	43.1	-15.5	0.0	64.17	74.0	9.83	Peak
									48.67	54.0	5.33	Average
2	7215	H	61.85	36.5	8.3	43.1	-15.5	0.0	63.55	74.0	10.45	Peak
									48.05	54.0	5.95	Average
3	12025	V	55.26	39.2	11.3	42.8	-15.5	9.5	53.46	74.0	20.54	Peak
									37.96	54.0	16.04	Average
4	12025	H	55.46	39.2	11.3	42.8	-15.5	9.5	53.66	74.0	20.34	Peak
									38.16	54.0	15.84	Average
5	7320	V	64.78	36.5	8.3	43.1	-15.5	0.0	66.48	74.0	7.52	Peak
									50.98	54.0	3.02	Average
6	7320	H	64.66	36.5	8.3	43.1	-15.5	0.0	66.36	74.0	7.64	Peak
									50.86	54.0	3.14	Average
7	12200	V	58.97	39.2	11.3	42.8	-15.5	9.5	57.17	74.0	16.83	Peak
									41.67	54.0	12.33	Average
8	12200	H	57.85	39.2	11.3	42.8	-15.5	9.5	56.05	74.0	17.95	Peak
									40.55	54.0	13.45	Average
9	7440	V	66.63	36.5	8.3	43.1	-15.5	0.0	68.33	74.0	5.67	Peak
									52.83	54.0	1.17	Average
10	7440	H	64.15	36.5	8.3	43.1	-15.5	0.0	65.85	74.0	8.15	Peak
									50.35	54.0	3.65	Average
11	12400	V	58.15	39.2	11.3	42.8	-15.5	9.5	56.35	74.0	17.65	Peak
									40.85	54.0	13.15	Average
12	12400	H	61.41	39.2	11.3	42.8	-15.5	9.5	59.61	74.0	14.39	Peak
									44.11	54.0	9.89	Average

Emission Level (Peak) = Rcvd + Ant Factor + Cable Loss – Amp Gain - Distance Correction

Emission Level (Avg) = Emission (Peak) + Duty Cycle Corr

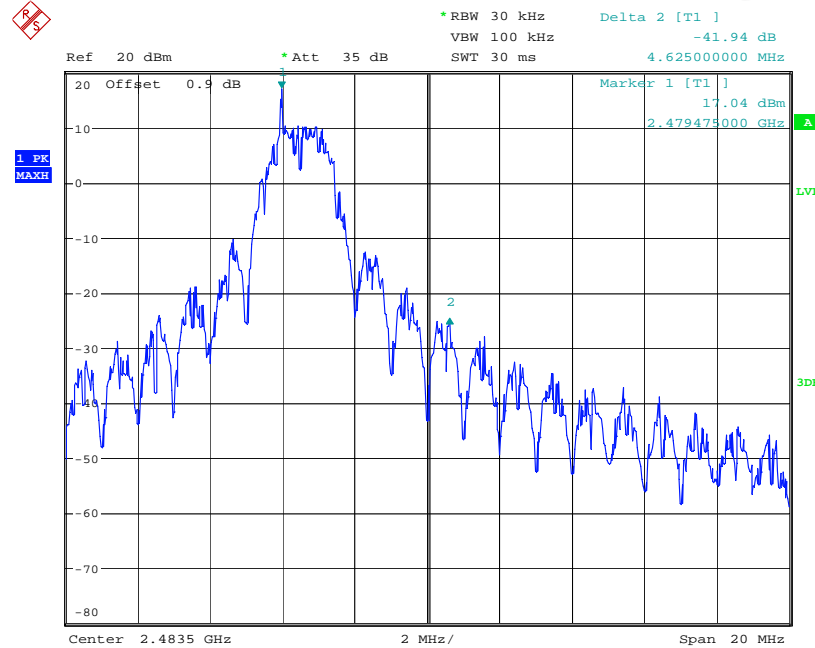
Duty Cycle:



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Duty cycle correction = $20\log((10 \times 1.67\text{msec})/100\text{msec}) = -15.5\text{dB}$

Delta Marker Measurement for 2.4835MHz Band Edge



Date: 2.DEC.2008 13:14:02

Measured Field Strength for High Channel in 1MHz RBW

Vertical = 111.43dBuV/m

Horizontal = 109.37dBuV/m

Delta Marker = -41.94dB

Therefore worst-case, Peak Field Strength = 111.43dBuV/m - 41.94dB = 69.49dBuV/m

Limit = 74dBuV/m

Average Field Strength = 69.49dBuV/m - 15.5dB(Duty Cycle) = 53.99dBuV/m

Limit = 54dBuV/m

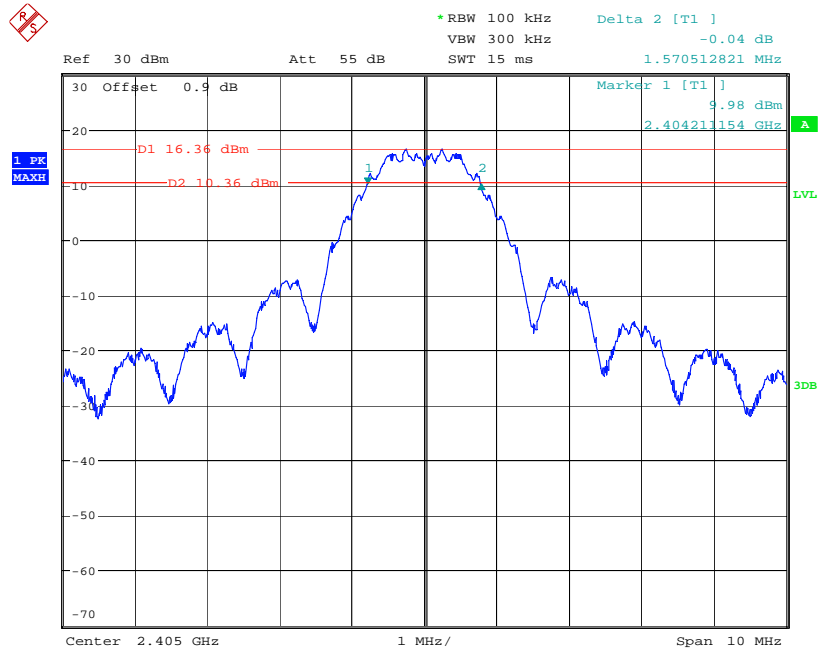
Clause 15.247(a)(2) Systems using digital modulation techniques

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

Test Results: Pass

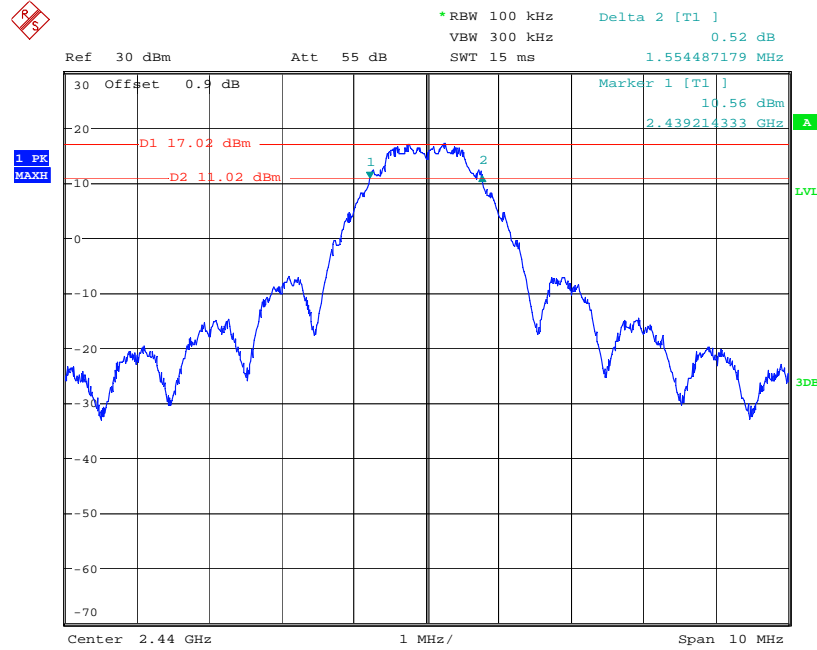
6dB Bandwidth:

Low Channel



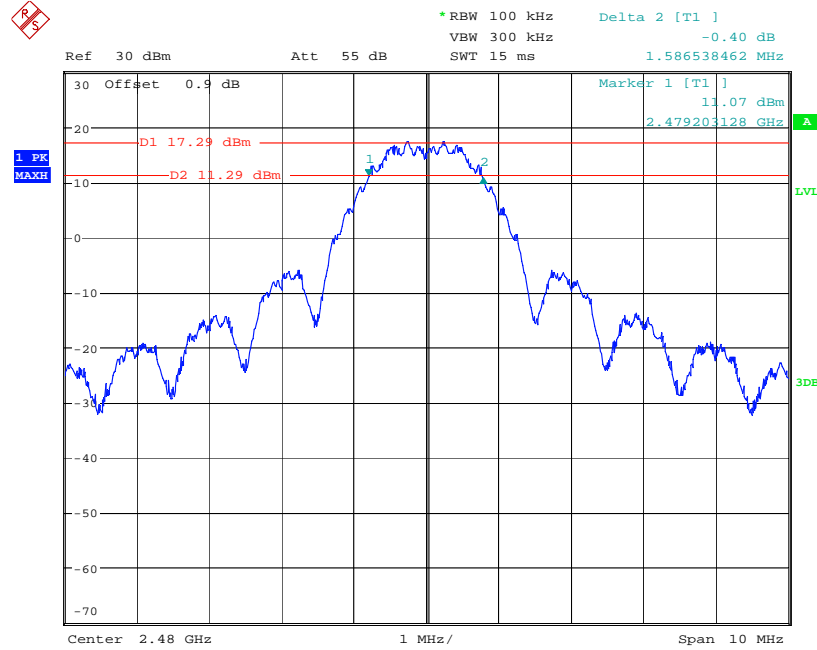
Date: 1.DEC.2008 10:35:07

Mid Channel



Date: 1.DEC.2008 10:46:19

High Channel



Date: 1.DEC.2008 10:56:51

Clause 15.247(b)(3) Maximum peak output power of systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Results: Pass

Conducted Output Power:

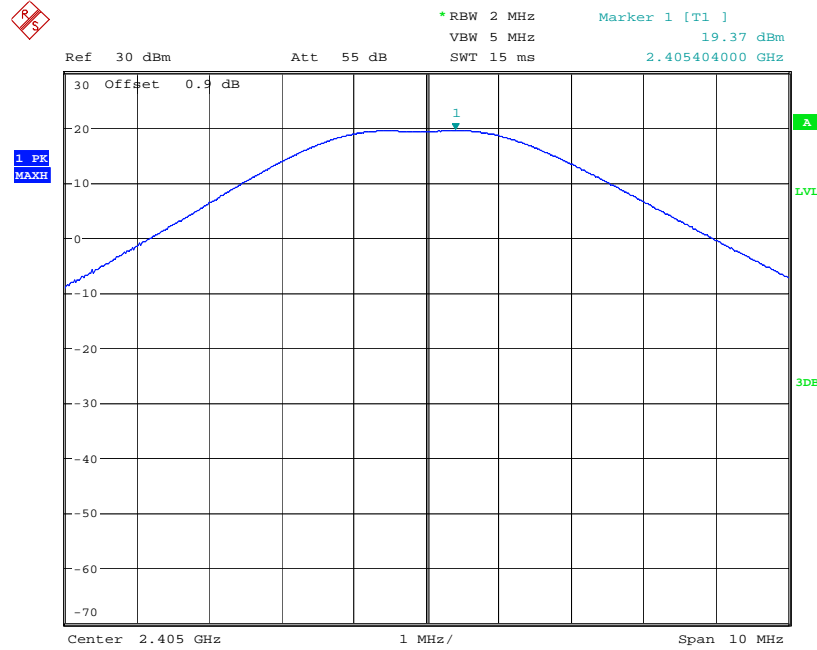
Measured output power = 20.03dBm
 Maximum output power = 20.03dBm + 1.5dBi = 21.53dBm EIRP
 Limit = 36dBm EIRP

The output power was measured at +/-15% of the supply voltage and found that there was no change.

Note: The EUT was modified by the manufacturer to perform conducted measurements. The Output power at the high channel is reduced by 6dB to comply with the Bandedge requirements.

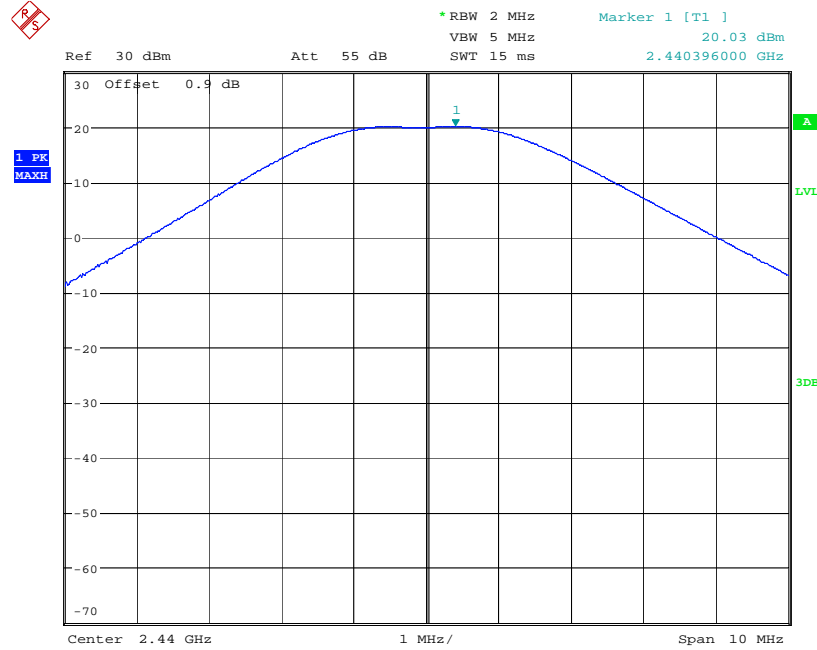
Channel Range	Measured Output Power (dBm)	Measured Output Power (W)
Low	19.37	0.0865
Mid	20.03	0.1007
High	14.79	0.0301

Low Channel:



Date: 1.DEC.2008 10:36:16

Mid Channel:



Date: 1.DEC.2008 10:46:54

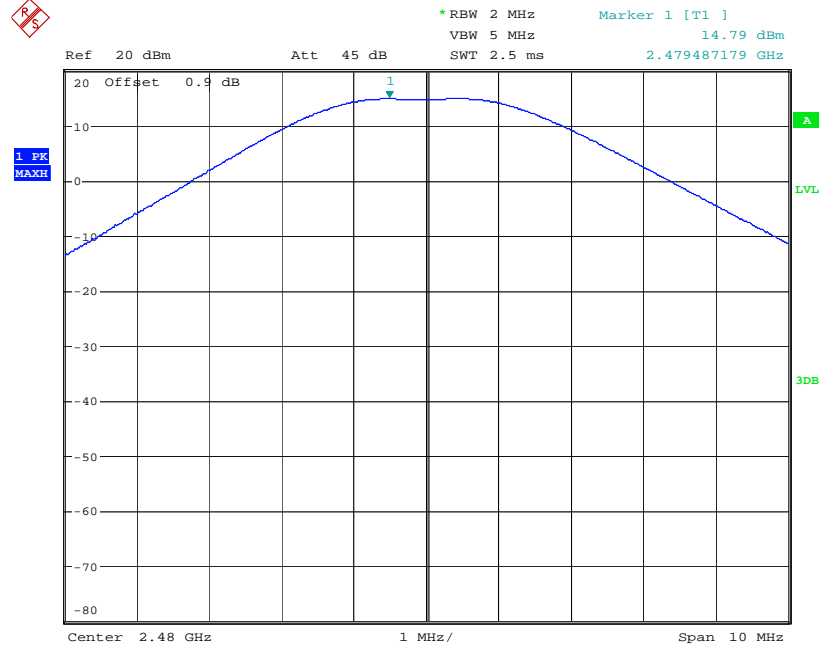


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Specification: FCC Part 15 Subpart C, 15.247

High Channel:



Date: 3.DEC.2008 18:21:43



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Clause 15.247(d) Radiated Emissions Not in Restricted Bands

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Results: Pass

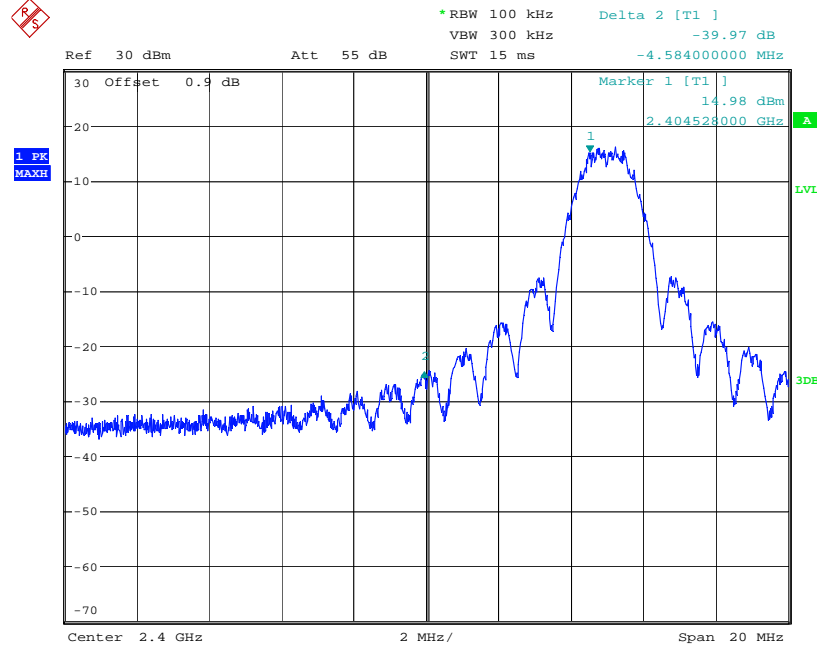


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Specification: FCC Part 15 Subpart C, 15.247

Lower Band Edge:



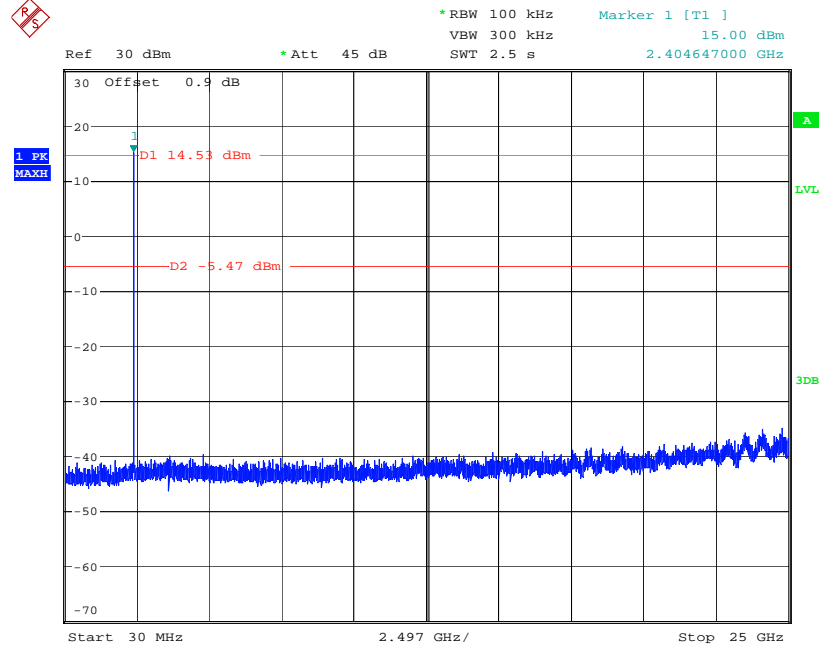
Date: 1.DEC.2008 11:10:32

Upper Band Edge:



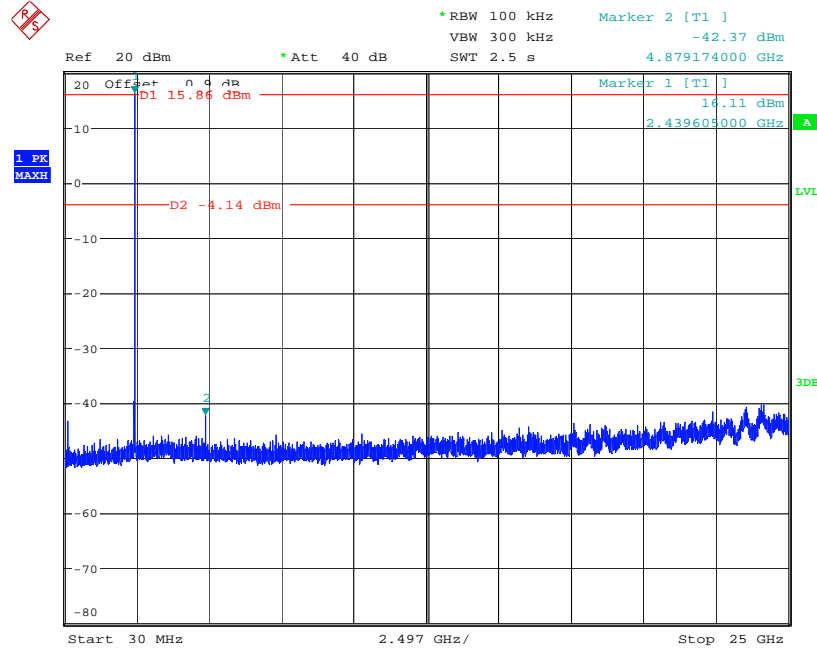
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**Conducted emissions:
 Low channel**



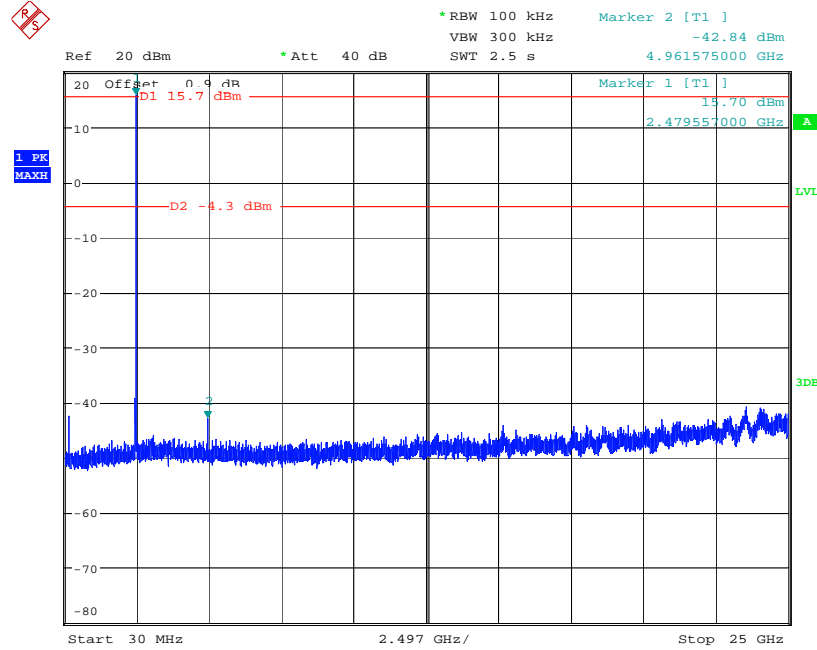
Date: 1.DEC.2008 10:43:12

Mid channel



Date: 1.DEC.2008 10:52:27

High channel



Date: 1.DEC.2008 11:08:08



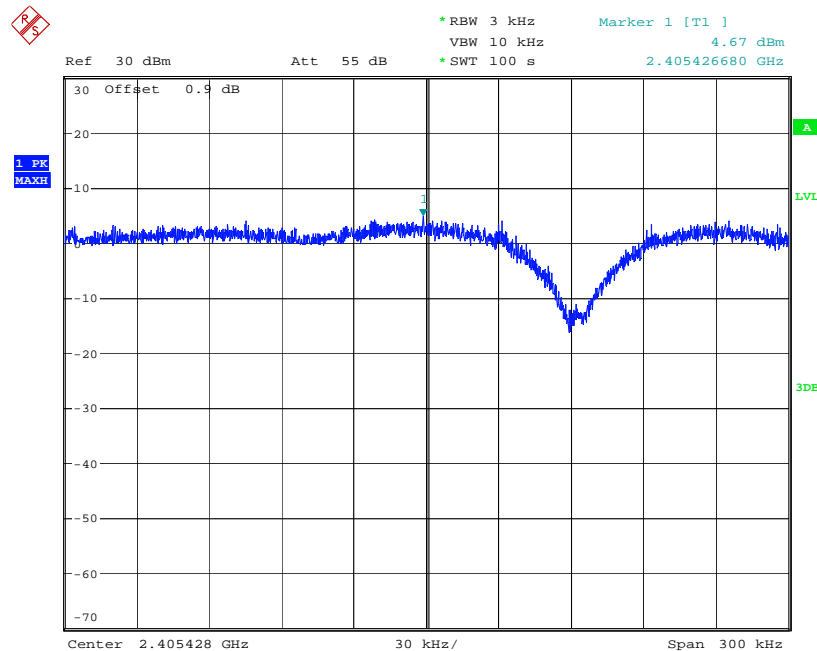
Clause 15.247(e) Power Spectral Density for Digitally Modulated Devices

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Results: Pass

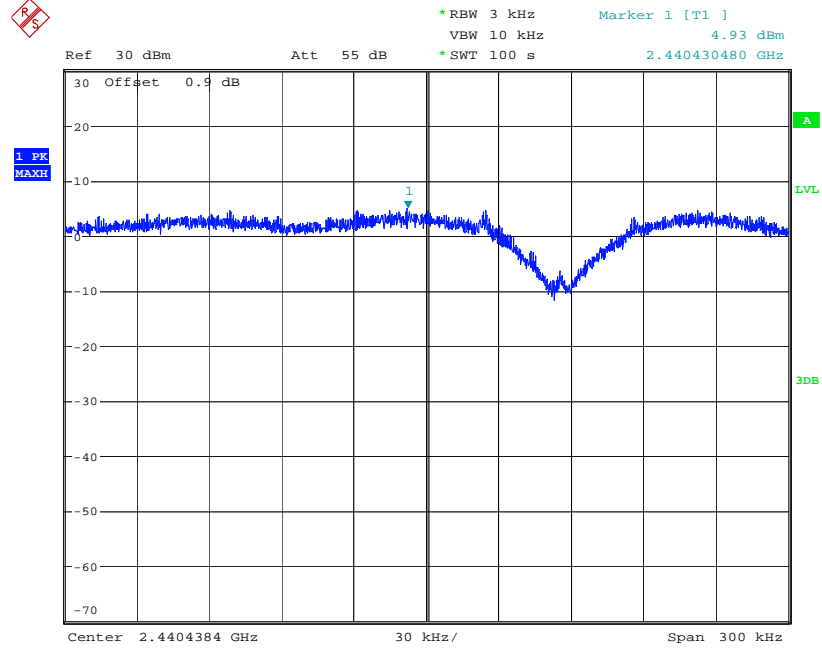
Channel Range	Measured PSD (dBm)	Limit (dBm/3kHz)
Low	4.67	8
Mid	4.93	8
High	6.38	8

Low channel



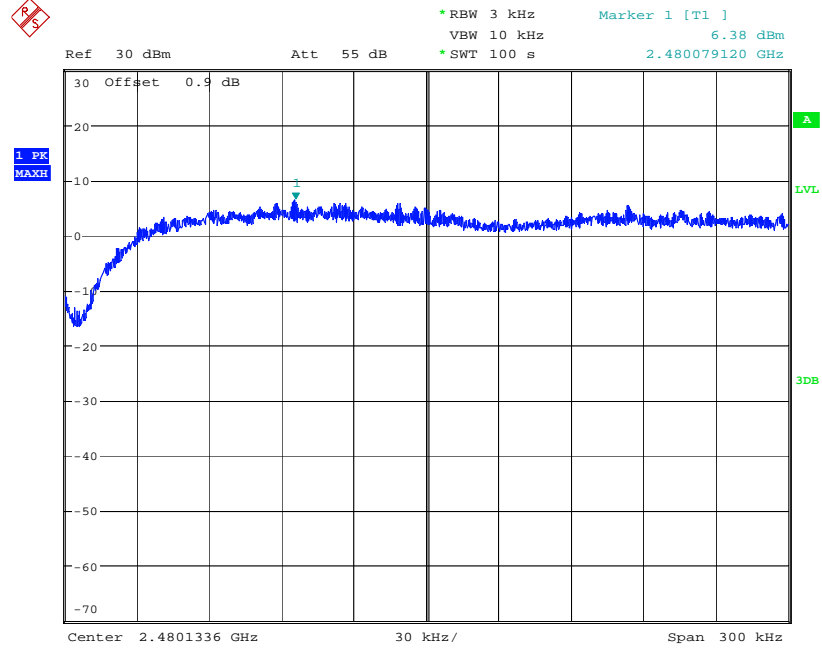
Date: 1.DEC.2008 10:41:30

Mid channel



Date: 1.DEC.2008 10:51:12

High channel



Date: 1.DEC.2008 11:06:58

Appendix B : Setup Photographs

Conducted Emissions Setup:

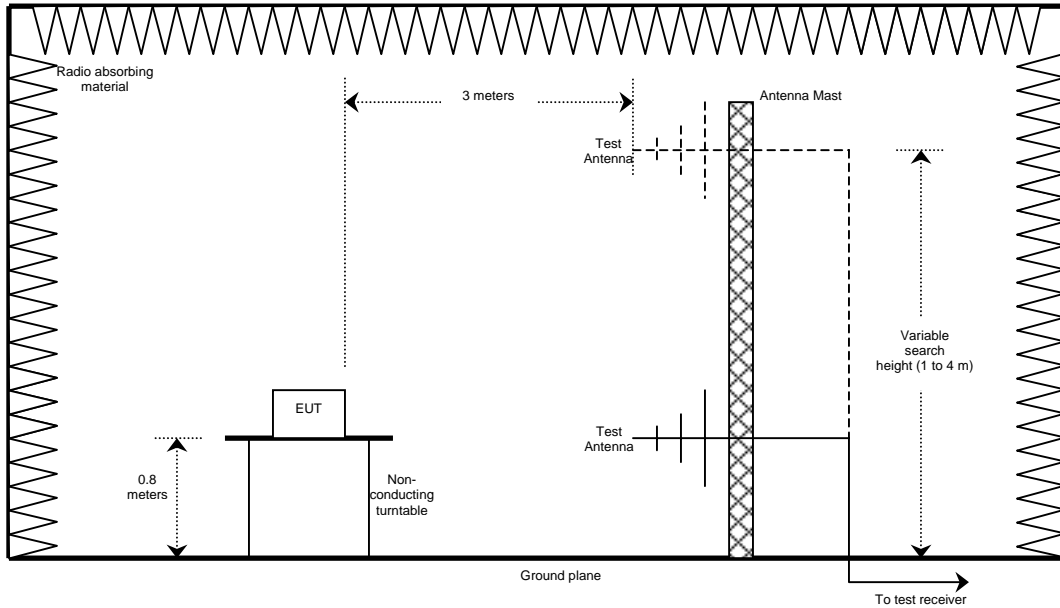


Spurious Emissions Setup:



Appendix C : Block Diagram of Test Setups

Radiated Emissions above 30MHz Test Site



Conducted Emissions Test Site

